CLEAN, INSPECT, VARNISH-TREAT, AND TEST PROPULSION GENERATORS AND MOTORS, SHIP SERVICE AND EMERGENCY GENERATORS IN-PLACE

1. SCOPE

1.1 Scope. This work item describes the requirements for the Contractor to clean, inspect, varnish-treat, and test main propulsion generators and motors, and ship service and emergency generators onboard Coast Guard vessels.

1.2 Alternate terminology. The term "machine", when used in this specification, shall imply propulsion generators and motors and ship service and emergency generators.

2. APPLICABLE DOCUMENTS

Naval Ships' Technical Manual (NSTM) Chapter 300, Dec 2000, Electric Plant - General

3. REQUIREMENTS

3.1 General.

3.1.1 Procedure submittal. The Contractor shall prepare a written process control plan for the cleaning method or combination of methods, which will be used (see 3.3 (Cleaning methods)), including disposal of generated wastes; submit the plan to the COR a minimum of 24 hours before the start of work.

3.1.2 Inspection and test notification and documentation. The Contractor shall abide by the following requirements for all inspections and tests specified herein.

3.1.2.1 Advance notice. Notify the Coast Guard Inspector at least 24 hours before performing each test and inspection, specified herein.

3.1.2.2 Documentation. Submit a CFR after completion of each inspection and test.

3.1.3 Protective measures. The Contractor shall furnish and install suitable covering to seal off and protect all non-affected surfaces/equipment and spaces in the vicinity of the work area against contamination during the performance of work. Upon completion of work, remove protective material and inspect for the presence of contamination. Clean all equipment and spaces, contaminated due to improper protection, to original condition of cleanliness.

3.2 Pre-cleaning procedures. Prior to performing cleaning requirements, the Contractor shall accomplish the following:

3.2.1 Access cover removal. Remove, clean, and retain all machine access covers.

3.2.2 Air gap clearances. For DC propulsion motors and generators, measure all main pole and interpole air gap clearances as follows, ensuring that the amount of removed varnish is kept to a minimum, and varnish residuals from the iron on the pole and the iron on the armature are removed, wherever measurements will be taken:

- Choose and non-destructively mark the centerline of each main pole on both ends (fore and aft), as well as a single point on each end of the armature.
- Align the mark on the armature with the mark on the number one main pole (arbitrarily chosen). Carefully measure the air gaps with a tapered feeler gauge to the nearest thousandth of an inch; record the readings in the "Main Pole" section, "A" columns (Fore and Aft) of the DATA SHEET 1 (Air Gap Readings) provided herein.
- Rotate the armature until the mark on the armature is aligned with the mark on the number two main pole; measure the air gap for the number two main pole, fore and aft, and record the measurement on the data sheet.
- Repeat the above procedures, until the mark on the armature has been aligned with the marks on each of the remaining main poles.
- Measure the interpole air gaps, as specified above for the main poles; record the readings in the "Interpole" section, "A" columns (Fore and Aft) of the DATA SHEET 1 (Air Gap Readings) provided herein.

3.2.3 Disassembly and inspections. Disassemble the machine, and accomplish the following inspections:

3.2.3.1 Visual inspections. Perform a visual inspection of the machine components, for the presence of contamination by dust, dirt, moisture, oil, and foreign matter (carbon, copper, and mica); inspect insulation surfaces and welded bars, including interpole and commutating field windings. For ship service and emergency generators, fabricate a cradle made of wood to support the rotor windings to permit high pressure water spray cleaning of windings. The weight of the rotor windings shall be supported by the shaft bearings to protect the windings from any damage.

3.2.3.2 Insulation resistance polarization index (PI) test. Measure and record the PI tests, in accordance with NSTM 300-3.4.12 (Polarization Index Test).

3.2.3.3 Voltage surge comparison tests. Perform and record the results of voltage surge comparison tests, in accordance with NSTM 300-3.5.4 (Voltage Surge Comparison Tests), to detect short circuited turns, coils or phases in the windings.

3.3 Cleaning methods. The Contractor shall employ one or a combination of the below-specified methods for cleaning the machine, as applicable, with the armature still supported by its bearings:

3.3.1 Compressed air. Use compressed air, to remove dry loose dust and foreign particles, particularly from inaccessible locations such as air vents in the armature punchings. Ensure the following:

- The compressed air is clean (oil free with the use of an oil filter) and dry.
- The air pressure does not exceed 30 pounds per square inch.
- The machine is opened from both ends, to allow a path of escape for air and dust.
- Extreme caution is used when using compressed air, particularly if abrasive particles are present.

3.3.2 Suction. Use suction to remove abrasive particles such as loose grit, iron dust, carbon and copper particles.

NOTICE!

A device such as a portable blower, equipped with a flexible tube attached to the suction side is permissible.

3.3.3 High pressure water spray and dry ice blasting. Select one of the following two methods, for removing hard-to-remove substances such as carbon build up, oil films, and dirt, which are typically found on electric rotating propulsion machines:

3.3.3.1 High pressure water spray. Accomplish cleaning by the use of a high-pressure spray using water and detergent, in accordance with NSTM 300-4.5.5 (High-Pressure Water Spray).

3.3.3.2 Dry ice blasting. Use a dry ice blast machine along with CO_2 pellets at a temperature of -109^0 F, as the blast media, to remove the surface contaminants. Ensure that the blast machine is capable of achieving a smooth, continuous pellet feed for the removal of contaminants, without damaging the insulation material. Remove airborne contaminants and particles, resulting from cleaning procedures, via negative ventilation and a filtration system having 99.97% containment.

NOTICE!

Post cleaning procedures (i.e. drying) is not necessary when performing dry ice blasting CO_2 cleaning.

3.4 Post-cleaning procedures. The Contractor shall perform the following post cleaning procedures:

3.4.1 Drying. Accomplish drying by the two following methods:

3.4.1.1 External heat. Fabricate a temporary oven, using any variety of materials such as heat-insulation panels secured to suitable frames, for the application of external heat. Ensure that the heat is generated from any of the following sources: electric heater, steam coils, radiators, stoves or hot air furnaces; and is steady or uninterrupted, to avoid condensation of moisture when approaching ambient temperatures. If steam is used, ensure there are no leaks, which might introduce moisture into the enclosure or machine(s). Provide ample ventilation for the escape of moisture. Monitor the temperature of the equipment being dried by temporarily installing thermometers, positioned so that they can easily be read. Ensure the following:

- The temperature of the air in the oven does not exceed 300 degrees Fahrenheit (149 degrees Celsius), when drying any class of insulation.
- The oven air temperature is maintained at 300 degrees $\pm$ 10 degrees, until the windings reach a temperature of 220 degrees Fahrenheit, and then adjusted to maintain the windings temperature at 220 degrees Fahrenheit $\pm$ 10 degrees until the windings are completely dry.

3.4.1.2 Circulating currents. Complete the drying process by the use of circulating current throughout the windings from an external low voltage current source.

3.4.2 Varnish treatment. When stated in the work item, or if a Change Request has been authorized and released by the KO, varnish-treat the cleaned armature, interpole, and field windings

with an air drying varnish in accordance with NSTM 300-4.5.8.5 (Air-Drying Varnish).

3.4.3 Insulation resistance polarization index test. When stated in the work item, or if a Change Request has been authorized and released by the KO, upon completion of cleaning and varnish treatment, repeat the insulation resistance PI tests, as specified in 3.2.3.2 (Insulation resistance polarization index (PI) test).

3.4.4 Reassembly. Reassemble the machine, after all tests and inspections have been accepted by the Coast Guard Inspector.

3.4.5 Brush renewal. For DC propulsion motors and generators, furnish and install new brushes into the brush rigging assembly as follows:

3.4.5.1 Ensure the brushes are sanded in to make good contact with the commutator by lifting the brushes enough to slide a continuous band of sand paper with the abrasive side away from the commutator.

3.4.5.2 Turn the commutator in the normal direction to achieve a brush contact to within 95 percent of full contact.

3.4.5.3 After the brushes have been installed and sanded, check and ensure the following:

- Brushes are free to move in the brush holder without sticking.
- Brush tension is adjusted to approximately 2-1/2 pounds per square inch of brush cross section area.
- The shunt terminals are firmly attached to the brush holders.

3.4.6 Commutator film restoration. For DC propulsion motors and generators, restore the commutator film in accordance with NSTM 300-4.7.8.7 (Restoring the Commutator Film).

3.4.7 Alignment. For propulsion, ship service and emergency generators, measure and record coupling and alignment readings for generator to diesel connections. Adjust as necessary to obtain agreement (within plus or minus ± 0.002 - inch) of the manufacturer's recommended alignment clearances.

4. QUALITY ASSURANCE

4.1 Sea trials. Upon completion of all work for propulsion

motors and generators, the Contractor shall conduct seal trials and demonstrate proper operation of machine. While the machine is in operation, record all operating parameters for the loads and times specified in Table I below.

TABLE I. SEA TRIALS - MAIN PROPULSION GENERATOR AND MOTOR OPERATING PARAMETERS

LOAD (percent)	TIME (minutes)	
25	120	*10% increments (35, 45, 55, 65, 75 and 85)
35-85*	30**	
95	60	
100	30	**30 minutes for each 10% increment

4.2 Ship service and emergency generator load test. Final acceptance shall be with both ship service generators fully functional and able to hold full load separately for one hour using ship's load.

5. NOTES

This section is not applicable to this work item.

DATA SHEET1. AIR GAP READINGS

VESSEL NAME: _____

HULL#:_____

POLE NO.	MAIN POLE				INTERPOLE			
	FORE		AFT		FORE		AFT	
	*A	**B	*A	**B	*A	**B	*A	**B
1								
2								
3								
4								
5								
6								
7								
8								

***Column A is for recording of preliminary air gap clearances.**
****Column B is for recording of post-installation air gap clearances.**

	NAME (Type/Print)	SIGNATURE	DATE
Contractor			
Test conductor			
USCG Inspector			
Ambient conditions:			